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PRICE AND OUTPUT RESPONSE OF MARKETED SURPLUS OF FOODGRAINS: A CROSS-SECTIONAL STUDY OF SOME NORTH INDIAN VILLAGES

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In a developing economy where the prospects of exports and/or foreign aid are not very bright and where the need for large imports of intermediate and capital goods leave little scope for commercial import of foodgrains, the flow of off-farm supplies of foodgrains may affect, at least in the short run, the feasible rate of industrial investment and employment. Even though production of foodgrains is the more important factor for long run development rather than its sectoral distribution, the nature of response of marketed surplus to changes in production and prices are important in connection with questions of forecasting urban availability, of estimating import requirements and possibly also of price policy.

Where producers of foodgrains are also their major consumers it is important to distinguish between the price elasticity of production of foodgrains (for a relatively long period covering the production adjustment lags) and the price elasticity of marketed surplus out of any given production (presumably a short-run elasticity). The long-run price elasticity of marketed surplus is a combination of these two elasticities. While the price response of production is likely to be positive,[1] the short-run price elasticity of marketed surplus may assume either sign (as explained below); and this introduces a complicating element in arriving at the long-run price elasticity of marketed surplus.

The literature on empirical estimates of the response coefficient of marketed surplus of foodgrains is rather small. The major reason for this, of course, is that available data on sales of

foodgrains in most underdeveloped countries are less adequate and satisfactory than most other kinds of agricultural statistics. In view of the lack of time series data for marketed amounts there have been some studies[2] estimating the price response of marketed surplus through an indirect approach. In a simplified form and assuming a time period long enough for complete adjustment of production to price changes the model for such indirect estimation is as follows. With S, O_f, C_f, P_f denoting the sales, output, consumption and average price of foodgrains, O_c and P_c the output and price of crops other than foodgrains, O being cultivators' total income [$O = O_f P_f + O_c P_c$] and assuming the consumer goods purchased by cultivators in exchange of crops to be the numeraire,

$$\text{let } S = O_f\,(P_f/P_c) - C_f\,(O, P_f) \ldots \qquad (1)$$

For a given cultivating population we then have

$$\frac{\partial S}{\partial P_f} \cdot \frac{P_f}{S} = \left[\gamma_f \cdot \frac{O_f}{S} - e_f \cdot \frac{C_f}{S}\left(\gamma_f \cdot \frac{P_f}{O} O_f - \gamma_c \frac{P_c}{O} O_c\right)\right] + \left[\frac{C_f}{S}\left(\sigma_f - e_f \cdot \frac{P_f O_f}{O}\right)\right] \ldots \qquad (2)$$

Where γ_f (γ_c) is the elasticity of production of foodgrains (other crops) with reference to the price ratio P_f/P_c (P_c/P_f) e_f is the income elasticity of cultivators' demand for foodgrains, and σ_f the price elasticity of demand (defined as positive).

For the short run of one agricultural year or for those cases[3] where foodgrains do not have any significant production substitutes, the first term on the right hand side of (2) would be zero, leaving

the second term as the price elasticity of marketed surplus. For a longer period and for the more usual cases where there are major competing crops the first term is also relevant and may have an important determining effect on the sign and the value of the elasticity. Behrman [3] in his study of rice in Thailand assumes the income and price elasticities of cultivators' demand to be zero. This leaves the long-run price elasticity of marketed surplus as equal to the price elasticity of production of rice multiplied by the inverse of the marketed proportion of production (i.e., $\gamma_f \cdot \frac{O_f}{S}$ in our equation (2)). This has a positive sign, since γ_f is positive. The crucial assumption of $e_f = \sigma_f = 0$ is based on his own estimate of demand function for all domestic consumption of rice in Thailand, with time series data for 1947-1962. This seems somewhat strange, and Behrman himself mentions the possibility of some serious limitations in the data used for estimating his demand function (e.g., unreliability of estimated figures of rice stocks, and the possibility of the actual temporal relationship between production and export being different from that assumed). In any case, from the estimates based on National Sample Survey data this does not seem to be the case in India.

Using the following plausible ranges of values from the available estimates for the agricultural sector of India, viz., e_f =0.5 to 0.8,[4] σ_f (defined as positive) = 0.2 to 0.4,[5] $P_f O_f/o$ = 0.45 to 0.55,[6] γ_f = 0.1 to 0.2,[7] and O_f/S = 3 to 4,[8] we may note that the

first term in (2) may range from +.25 to +.85, the second term or the short-run price elasticity of marketed surplus from -.72 to +.52, and hence the whole expression may have a value ranging from -.47 to +1.37. It seems that the uncertainty regarding the sign of the long-run price elasticity of marketed surplus when estimated indirectly and in aggregative terms[9] arises primarily from the uncertainty regarding the sign of the corresponding short-run elasticity. A more direct estimation of the latter, possibly through regression analysis of cross-sectional data in the absence of time series, may reduce the extent of the uncertainties involved. This paper using some village level cross-sectional data gives a direct regression estimate of the short-run price elasticity of marketed surplus for north-west India.

For the cross section of villages considered in this paper there is no significant correlation between production and price of foodgrains;[10] this may not seem surprising as the price and the output figures for a village refer to the same year and as conditions of income and hence demand are likely to be very different among the villages. In view of this, the price elasticity of the marketed proportion of production would be the same (in sign and approximately in magnitude) as the price elasticity of marketed surplus for the particular sample. Here we have considered the marketed proportion of production as the dependent variable affected by price and other factors, as this is the form in which the question of

marketed surplus more frequently is posed in the short run with a predetermined level of production.

Since the price response of the marketed proportion is likely to be affected by the level of production itself, the income of cultivators from other production, and the size distribution of production, these have to be considered as independent variables in the regression analysis. This would indicate the effect of these other factors along with that of price for the region considered.

Data:

From the socio-economic surveys of villages carried out by the Agricultural Economics Research Centre at University of Delhi we collected data--for twenty-seven villages of Punjab and Uttar Pradesh--relating to the marketed proportion of foodgrain production and some of the major economic factors that might influence it. These are given in Appendix Table A.1.

Each observation in Table A.1 relates to all the cultivators (owner, tenant, and mixed) in a village put together. The dependent (Y) and the explanatory variables (X's) are defined as follows:

Y: Total amount of foodgrains (cereals and pulses) sold by the cultivators in a village as percentage of production of foodgrains; figures used for both sales and production are in quantity terms (maunds that are equivalents of 82.3 lbs.). It may be noted that the quantity sold in the numerator is

not equal to the entire quantity disposed of by the cultivators. It does not include the payments in kind of wages and rent. Since the relative importance of cash and kind payments of costs differs among the villages, it seemed more appropriate to treat the payments in kind as an independent variable.

X_1: Foodgrain production (in maunds) per adult unit of the cultivating population of the village. Per adult unit rather than total amount is considered in order to take account of inter-village differences in size and age-sex composition of the cultivating population. Adult units are obtained by applying a conversion ratio based on the age and sex structure of the population of the village concerned. A minor (less than or equal to 15 years) is taken as equivalent to 0.8 unit and an adult female to 0.9 unit as far as grain consumption is concerned.

X_2: Average price of foodgrains for the cultivators in a village. The village surveys do not quote any market prices as such, but give only the quantities and the values of production and sales of different foodgrains. For each village the average grain price (rupees per maund) is derived from dividing the total value of grain production by the total volume, which is equivalent to the arithmetic mean of the prices of different foodgrains weighted by their respective

production levels. An alternative index of average price could be derived by using the quantities sold of the different grains as weights, i.e., from dividing the total value of sales by the total volume of sales. This index (call it X'_2) may be less useful than the former for explaining cultivators' marketing decisions except in a situation where the proportion of production sold is the same for different grains and for different villages. We have used both the indexes, and as noted in the table below they do not make much difference to the results for the particular sample.

X_3: Value of production of commercial crops other than foodgrains defined as per adult unit of the cultivating population in a village.

X_4: Average income of cultivators from sources other than the production of crops. Over most parts of Punjab and Uttar Pradesh, livestock products (milk and ghee) form the most important source of income for the cultivators outside the production of crops. Hence X_4 in our model stands for the value of production of milk (and its products) per adult unit of the cultivating population.

X_5: Index of concentration of cultivated acreage in a village. Cultivating households and cultivated area in a village are classified into three size-groups: up to 5 acres, 5 to 15,

15 acres and above. The concentration index is then obtained by summing the absolute differences between the cumulated percentages of farms and of cultivated area in each size class, and dividing the sum by 100.[11] The larger the difference between the percentage of farms and the percentage of area in each size class the larger is the index. When the proportion of farms in each size class equals the proportion of area in the corresponding size class, the index assumes a value of zero. Provided the farms and the cultivated area are distributed among all of the specified size-classes (as it is the case with the villages considered here) instead of being exclusively concentrated in any one of them, it may be said that with rise in the degree of concentration of area in the upper size classes the index would go up with a maximum limit equal to unity.

X_6: Other disposals of foodgrains (i.e., other than sales) minus other receipts of foodgrains (i.e., other than what is produced on the farm) as proportion of foodgrain production. These other disposals consist of rent and wage payments in kind. Some of these disposals may be mutual payments among the cultivators themselves. To exclude these mutual payments and to obtain the net disposal of foodgrains by the cultivators as a group to the pure rent receivers and the agricultural laborers, we have subtracted the sum of 'other receipts' of

foodgrains by the cultivators from the sum of 'other disposals' of grains.

We may now turn to analyze the inter-village observations presented in Table A.1. As noted in the Table, the reference year is not the same for the different observations, though most of them cluster within the Second Plan period--a period during which the effects of Bhakra Nangal irrigation and of consolidation of holdings were being felt widely in rural Punjab. The non-uniformity of reference year need not make an inter-village analysis of marketed surplus impossible. By including some of the major structural factors among the explanatory variables, one can take care of most of the effect of differences in reference year on the dependent variable. In an analagous way it can be argued that if for the same village the values assumed by the dependent and/or by some of the explanatory variables are found to be different as between two points of time separated by a few years, then they may be treated as constituting practically two different observations for the purpose of the inter-village regression analysis. Village Sohalpur Gara, for example, was enormously different in 1958-59 (when the resurvey was made) from 1954-55 (year of the initial survey) as a result of the setting up of a sugar mill only a little over a mile away, and the construction of a road connecting the village with the mill and of two large tubewells that irrigated 68% of the cultivated area where previously there was little irrigation. In an important economic sense the two surveys give us two distinct cases. In the following regression analysis we have

first included both of the double point surveys for the villages surveyed twice, and then excluded one of them from the sample. This change in the sample produces little striking difference in the results (Table 1)--which, incidentally, justifies the above argument.

Though confined mainly to one region of the country, the selected villages present quite a varied cross section of economic conditions. Village Lodi Nangal, for example, is electrified, has almost 100% of its cultivated area under irrigation; most of its cultivators keep milch cattle to meet the demand of a government dairy only 15 miles away. The Ferozepur villages have large-sized operated holdings in many of which improved implements, including tractors, are used for wheat cultivation. These villages are in striking contrast to some villages from Uttar Pradesh, like village Palanpur which has very poor soil subject to recurrent floods and small-sized holdings cultivated with backward techniques. As for the size-distribution of cultivated area, in village Dughri only 3 of the 53 cultivating households had holdings equal to or smaller than 5 acres; in Koloyee, on the other hand, about half of the cultivators belonged to this size-class. Operational holdings in the size-group of '15 acres and above' accounted for 10% or less of all holdings and for 30% or less of all cultivated areas in Bhojpur, Dhakia, Mehtiana, Rawatpur and Palanpur; on the other hand, this size-class accounted for more than 60% of holdings and more than 80% of the cultivated area in Sarai Naga, Patran, Lodi Nangal, and Rataul Rohe.

There are substantial differences even among villages within

the same district and for the same village between two surveys.

Some Theoretical Considerations:

Before considering the regression estimates, we may note the signs of the response coefficients as expected theoretically. For this we shall use a slightly modified version of equation (1) in order to take account of the way in which the variables are defined for our regression model. Let $S = O_f - C_f - N$ ... (3)

Where N is net other disposal (i.e., payments in kind minus receipts in kind) of foodgrains and the other terms as defined earlier.

As before let us assume, for the sake of simplicity, the basket of consumption goods purchased by the cultivator to be the numeraire good and its price to be unity. Then from (3), assuming a simple demand function with only income and price, we obtain

$$s = \frac{S}{O_f} = 1 - \frac{C_f(O,P_f)}{O_f} - n \qquad (4)$$

where the cultivator's total income is $O = P_f O_f + P_c O_c + P_m O_m$, $P_f O_f$ and $P_c O_c$ being the value of production of foodgrains and other crops respectively, $P_m O_m$ being the value of production of milk and milk products (which constitute the main source of income outside crop production for the North Indian cultivator), and n is net other disposal of foodgrains as a proportion of output.

From equation (4), which shows s (or Y) as a function of O_f (or X_1), P_f (or X_2), n (or X_6) and other incomes (X_3 and X_4), the theoretical

counterpart of the partial regression coefficient of s on O_f, with other variables as given, would be

$$\frac{\partial s}{\partial O_f} = \frac{\partial Y}{\partial X_1} = \frac{C_f}{O_f^2} \left(1-e_f \cdot \frac{P_f O_f}{O}\right) , \qquad (5)$$

e_f as before denoting the cultivator's income elasticity of demand for foodgrains.

Similarly,

$$\frac{\partial s}{\partial P_f} = \frac{\partial Y}{\partial X_2} = \frac{C_f}{O} \left(-e_f + \frac{\sigma_f}{P_f O_f} O\right) , \qquad (6)$$

σ_f being the cultivator's price elasticity of demand for foodgrains defined as positive.

Considering the plausible ranges of values for the parameters as noted earlier in the case of rural India as a whole, the output response of the marketed proportion of output ($\frac{\partial Y}{\partial X_1}$) would be non-negative. The price response coefficient ($\frac{\partial Y}{\partial X_2}$ in terms of our Tables) may or may not be negative. But the likelihood of obtaining a negative coefficient rises as e_f and/or $P_f O_f/O$ tend to have larger values within the assumed range and/or as σ_f tends to have smaller values.

Since price changes in one year can not affect production before the next year or the next sowing season, there need not be any relationship between figures of prices and outputs in a cross section of cases as in Tables A.1 and A.2. As a matter of fact, the coefficient of correlation between average grain price (P_f) and production of grains (O_f)

is -.04 for the sample of cases in Table A.1, and +.05 for the sample in Table A.2, both of which are statistically insignificant. A positive price elasticity of production (which comes in the long-run price elasticity of marketed surplus) and a positive production elasticity of marketed surplus thus need not be contradictory to the possibility of a negative short-run price elasticity of marketed surplus. In other words, even when for a cross section of cases $\frac{\partial Y}{\partial X_2}$ is negative coupled with a positive $\frac{\partial Y}{\partial X_1}$, there can be a positive $\frac{\partial X_1}{\partial X_2}$ (with a time lag between X_1 and X_2) in a time series for any of those cases.

Considering the dependence of total income O on $P_c O_c$ (or X_3) and $P_m O_m$ (or X_4), $\frac{\partial Y}{\partial X_3}$ and $\frac{\partial Y}{\partial X_4}$ from equation (4) may be expected to be negative.

From Equation (4) it also seems that $\partial Y/\partial X_6$ is likely to be negative since $\partial s/\partial n < 0$. Between two villages or cultivators with similar production conditions, a larger volume of net disposal other than sales may arise from any of the following: (a) if the proportion of total cost (wages, rent and others) that is paid in kind is larger, which may be due to institutional reasons, (b) if total paid-out cost itself is larger (which may arise from a larger ratio of leased in area to cultivated area, larger employment of labour, or higher rates of rent and wage), (c) if more of the purchased consumption goods and services are obtained through direct barter. In case (c) this 'other disposal' constitutes a part of the marketable surplus, so that even with unchanged output and marketable surplus of grains, the quantity actually marketed will vary inversely with net other disposal. In case (b), net grain

production, X_1 $(1-X_6)$, and hence cultivator's real income would be smaller where the other disposal is larger; and this would reduce the marketed surplus out of any given gross production provided the cultivator's marginal propensity to consume foodgrain is smaller than unity. In case (a), changes in other disposal would inversely change the marketed proportion of total marketable surplus and of production; a larger proportion of kind payment of costs would lead to a smaller quantity sold by the cultivators in the market.

The response of marketed proportion of production to X_5, i.e., the degree of concentration in the size distribution of land (as a proxy for the distribution or production) is likely to be positive as long as the response of the marketed proportion to change in production is positive and if larger-sized holdings are associated with larger levels of grain output per consuming unit.

Unless there are substantial sampling errors or omission of relevant independent variables, the estimated coefficients when statistically significant should conform to the expected signs.

In our multiple regression coefficients we have assumed a linear relationship, while the real situation need not necessarily be characterized by such linearity. However, so far as the signs of the coefficients are concerned the assumption of linearity is likely to give results similar to that of non-linearity. And as noted in Table 1, the linear equation gives a good fit for the sample.

Results

Table 1 indicates that the linear regression estimates of marketed proportion of production on grain production are positive and significant, and on grain price negative and significant throughout. The remaining regression coefficients are of the expected sign except that of Y on X_3 which in some estimates turns out to be positive though statistically insignificant. The variables with statistically significant influence on marketed proportion of production in the sample of villages are the average production and price of foodgrains, and in some cases also the average income from milk production in a village and net disposal of foodgrain in the form of payments in kind as a proportion of production.

Two aspects of these results seem to be rather important. One is that the regression coefficient of the marketed proportion of production on production itself is significantly positive; i.e., that the volume of marketed surplus is a quadratic function (with positive second derivative) of the average level of foodgrain production. This is analogous to the time-series case of the marginal propensity to sell foodgrain rising with the production. From Table 1, the output elasticity of the marketed proportion of output for the sample of villages is about .8 (.7 if we take X_2' instead of X_2), and the corresponding output elasticity of amount marketed is 1.8 (1.7 with X'_2). We may note from our equation (5) that for the output elasticity of marketed surplus to be more than unity a sufficient condition is that cultivators' income elasticity of demand for foodgrains be less than (or equal to) unity.

Table 1: Marketed Surplus Function: Regression Coefficients for a Cross-Section of North Indian Villages

Sample	Constant Term	X_1	X_2	X_3	X_4	X_5	X_6	Degrees of Freedom	R^2	Sample Elasticity of Y to: X_1 (at mean)	Sample Elasticity of Y to: X_2 (at mean)
(a) All 31 cases of Table A.1	24.913*	1.293*	-1.351*	.068	-4.683***	9.549	-.097	24	.674*	.788	-.575
(b) 27 cases of Table A.1 excluding one of each double point surveys	28.814*	1.265*	-1.447*	.527	-8.157*	7.021	-.048	20	.692*	.774	-.599
(c) All 27 cases of Table A.2	32.740*	.808*	-.926***	.234	-4.350***		-.242	21	.466*	.595	-.330
(d) 22 cases of Table A.2, using criterion (ii)	58.842*	.574*	-1.273***	-1.098	-3.608		-.907*	16	.530*	.432	-.448
(e) 19 cases of Table A.2 using criterion (iii)	48.656*	.727*	-.840	-.868	-7.430***		-.514	13	.452*	.578	
Sample: same as (a) but with X'_2 instead of X_2	29.887*	1.176*	-1.641*	.738	-4.147	7.514	-.083	24	.706*	.717	-.738
Sample: same as (b) but with X'_2	31.308*	1.168*	-1.632*	1.145	-7.343**	5.699	-.013	20	.717*	.719	-.712
Sample: same as (c) but with X'_2	36.000*	.796*	-1.245***	.554	-4.184		-.233	21	.476*	.585	-.464
Sample: same as (d) but with X'_2	58.655*	.587**	-1.359***	-.828	-3.692		-.863*	16	.529*	.442	-.498
Sample: same as (e) but with X'_2	47.627*	.723*	-.615	-.969	-7.396***		-.560	13	.438*	.574	

*Significant at 1-5 per cent level; ** Significant at 5-10 per cent level; ***Significant at 10-25 per cent level.
Source: Tables A.1 and A.2
Note: Use of the alternative index X'_2 of average gain price with the quantities sold as weights leads to very little difference in the results relating to signs of the coefficients in particular. This is indicated below.

The other important observation relates to the negative sign of the price response of marketed surplus as a proportion of production and also in absolute terms (since O_f and P_f are unrelated for the cross section of cases in Table A.1, a negative $\partial(S/O_f)/\partial P_f$ also implies a negative $\partial S/\partial P_f$). For our sample of villages, the estimated value of the elasticity is -.6 (-.7 if we take X'_2 instead of X_2). As is apparent from Table 1, this negative response of marketed proportion of production to changes in foodgrain price is net of the effect of changes in the price-ratio and the output-ratio between foodgrain and other crops (which affect variable X_3, with given X_2 and X_1) or, more generally speaking, it is net of the effect of changes in cultivators' income from sources other than foodgrain production (X_3 and X_4).

A change in grain price affects marketed surplus both directly and through its effect on the cultivator's income. The consistently negative price elasticity of marketed surplus thus implies, for this cross-section of villages at least, that the rise in income generated ceteris paribus by larger grain price leads to a rise in demand for retention[12] of foodgrains large enough to outweigh the negative substitution effect on consumption. This negative price response suggests the possibility that a fall in grains price due to food price regulations or imports may not have an adverse effect on marketed surplus at least during the short period of one crop year. As long as income elasticity of demand for foodgrains remains large in the agricultural sector, this possibility should not be ignored. In this connection it may be worthwhile to find out if the price response coefficient is negative

even in the case of a subset of richer cultivators whose income elasticity of demand for foodgrains is likely to be smaller. For this purpose we have carried out some additional estimates of output, price and other response coefficients for the "richer" sub-samples.

In doing this we immediately face the complicated problem of defining 'better-off' cultivators with specific reference to the villages under consideration. We have used three rough and progressively more limiting criteria which are discussed in more detail in the note to Table A.2. These are: (1) grouping together--for each village--only the cultivators with operational holdings of 10 acres and above (this gives us the 27 cases described in Table A.2); (ii) out of these 27, selecting only the cases (22) for which a 10 acre holding yields an annual income (net of paid costs of cultivation--see note to Table A.3) worth about Rs. 1000 or more which may be regarded as above the subsistence minimum for the period under consideration; (iii) in order to study the marketing behaviour of cultivators who are better-off not only in terms of total farm income but also in terms of grain production, we have picked out 19 cases out of the 22 from (ii) such that in each the level of grain production per adult unit for the larger cultivators (with more than 10 acres) is not less than 15 maunds in a year[13] (i.e., not less than 100 pounds per month).

Comparing regressions (c) - (e) with the results obtained from the earlier, more general sample (regressions (a) and (b)), one finds that the marketed proportion of production is positively related in a statistically significant way to production level even in the case of

the richer subsamples. The estimated output elasticity of marketed surplus (net of the effects of the other variables) is around 1.7. The cross-sectional price elasticity of marketed surplus, though still negative, appears to be smaller in magnitude and statistically less significant than in the case of the general sample. Referring back to equation (6), we may note that the likelihood of obtaining a negative price elasticity of marketed surplus declines as the income elasticity of demand for foodgrains and/or the importance of foodgrains in total farm income becomes smaller. The value of foodgrains production as a proportion of total income of cultivators from crops and livestock products is only slightly smaller for the richer sample of Table A.2 than for the sample of Table A.1 (39% as against 40%). But the income elasticity of demand, from the available National Sample Survey data, seems to be smaller for the upper income classes than for all the income or expenditure classes put together. This may give us a plausible explanation for the weaker negative price elasticity obtained for the richer subsamples.

All this seems to indicate that at the present stage the agricultural sector as a whole in countries like India may <u>not</u> necessarily market more grains during a year when grain price is going up, but this might be less of a problem for relatively more prosperous regions or farmers.

Needless to mention that our study is in terms of a very simplified framework and carried out on the basis of evidence with regard

to a specific region. But, for whatever they are worth, our results show that the price elasticity of marketed surplus in the short run may be negative and since this forms a part of the long-run price elasticity--as in our equation (2)--the value of the latter, even when positive, will be lower than otherwise. Our results also seem to indicate that the poorer is the set of cultivators considered the more important is this possibility.

Table A.1

Factors Affecting Marketed Surplus as a Proportion of Production of Foodgrains (Y) in 27 Villages of Uttar Pradesh and Punjab

Name of Village	Reference Year	Y	X_1	X'_2	X_2	X_3	X_4	X_5	X_6
Rataul Rohe	1955-56	45.5	27.4	12.73	13.88	1.16	2.79	0.485	10.3
Rataul Rohe	1960-61	36.8	30.7	14.01	14.04	2.08	1.45	0.397	11.3
Palanpur*	1957-58	12.9	5.5	15.23	14.64	0.77	0.63	0.459	12.2
Saran	1954-55	18.0	17.6	8.64	7.06	1.01	2.58	0.310	11.7
Saran	1959-60	13.9	15.1	16.08	14.87	1.20	1.16	0.262	14.4
Dughri	1956-57	20.9	16.3	14.00	13.66	2.73	1.14	0.190	20.3
Mehtiana	1957-58	22.4	12.0	14.61	14.62	2.36	0.70	0.230	22.6
Rawatpur*	1957-58	24.7	8.3	12.34	12.52	1.15	0.46	0.375	14.7
Sohalpur Gara*	1954-55	33.2	13.4	10.63	8.74	1.31	0.81	0.214	7.0
Sohalpur Gara*	1958-59	26.2	13.1	12.47	12.59	1.72	0.54	0.328	13.6
Walidpur*	1958-59	11.4	10.1	17.44	16.55	6.25	0.80	0.508	17.8
Kukar Majra	1956-57	28.2	19.9	14.92	10.76	2.62	1.45	0.254	20.6
Koloyee*	1957-58	17.1	8.8	15.63	14.67	1.81	0.73	0.922	19.8
Ghiana	1954-55	29.2	18.3	9.80	8.31	3.41	0.68	0.355	17.4
Patran	1957-58	40.8	28.5	10.89	11.75	1.52	1.21	0.150	16.3
Noorpur	1955-56	30.4	11.6	11.67	11.69	0.99	0.95	0.377	29.9
Naunera	1954-55	46.7	24.7	6.49	6.69	1.62	1.41	0.385	14.7
Shamaspur*	1954-55	9.6	9.1	10.83	8.67	0.74	0.35	0.228	28.1
Meharwani	1954-55	38.1	10.4	11.14	9.70	2.04	1.11	0.256	21.4
Sochiana	1957-58	41.7	28.9	12.82	12.09	1.85	1.39	0.455	28.1
Lodi Nangal	1957-58	35.7	30.5	11.24	11.25	1.88	1.40	0.142	28.7
Bhatian	1960-61	50.2	20.7	14.44	12.57	7.12	0.70	0.458	10.0
Sarai Naga	1955-56	59.2	49.5	15.11	12.95	10.76	2.12	0.195	0.0
Kala Jhar*	1956-57	31.9	21.3	13.07	11.97	2.79	1.68	0.410	19.2
Dhakia*	1958-59	10.2	7.8	17.86	14.65	1.19	0.22	0.290	9.1
Arwah	1955-56	23.3	11.9	8.34	9.91	0.50	0.46	0.325	18.4
Akoi	1956-57	16.9	20.1	13.75	14.41	3.09	1.78	0.364	12.3
Bahautwas	1955-56	26.6	8.3	6.91	7.08	0.35	0.46	0.517	6.1
Bahautwas	1959-60	4.2	3.2	14.14	13.02	0.51	0.26	0.448	8.4
Bhunderi*	1958-59	31.1	11.4	10.29	10.72	1.22	0.44	0.205	15.4
Bhojpur*	1954-55	28.5	11.5	12.15	12.63	0.77	0.20	0.196	12.4
Arithmetic Mean		27.9	17.03	12.55	11.89	2.21	1.03	0.345	15.88

Source: Village Surveys by the Agricultural Economics Research Centre at the University of Delhi.

Note: 17 of these villages belong to the state of Punjab, and 10 to Uttar Pradesh. Villages in Uttar Pradesh are distinguished by an asterisk.

Table A.2

Factors Affecting Marketed Surplus as a Proportion of Foodgrains Production (Y) for Cultivators with Holdings $\geq$ 10 acres, in 25 Villages of Uttar Pradesh and Punjab

Name of Village	Y	X_1	X'_2	X_2	X_3	X_4	X_6
Rataul Rohe I	47.6	43.3	12.73	12.18	1.59	3.61	10.4
Rataul Rohe II	39.0	57.6	14.02	13.58	3.97	2.28	13.4
Palanpur	13.7	12.6	14.78	14.82	1.91	0.89	16.6
Saran I	19.3	17.6	8.61	6.93	0.99	2.66	10.5
Mehtiana	36.5	14.1	14.60	14.63	3.20	0.97	10.5
Rawatpur	35.0	16.7	11.97	12.32	2.63	0.65	15.5
Walidpur	14.6	17.5	17.60	16.40	11.42	1.31	13.6
Kukar Majra	28.4	22.2	15.43	13.44	3.75	1.32	20.3
Koloyee	29.5	21.9	14.96	16.28	6.33	1.02	12.1
Patran	40.7	21.9	10.94	11.75	1.64	1.23	17.1
Noorpur	35.1	18.1	11.85	11.73	1.44	1.15	28.2
Sochiana	50.4	42.0	12.96	12.31	2.42	1.44	20.0
Bhatian	53.4	16.4	14.44	12.52	5.49	0.73	6.6
Sarai Naga	59.2	49.5	15.11	12.95	10.76	2.12	0.0
Kala Jhar	32.0	24.4	13.07	11.97	3.18	1.68	21.5
Akoi	17.4	28.1	13.76	14.39	4.39	2.29	12.7
Bahautwas I	26.7	12.4	7.02	5.56	0.72	0.45	7.2
Bahautwas II	6.0	5.0	14.22	13.89	0.76	0.26	6.4
Bhunderi	40.1	12.7	10.01	10.59	1.27	0.34	19.6
Bhojpur	25.9	13.5	13.06	13.64	1.43	0.49	19.5
Lodi Nangal	37.0	38.9	11.25	11.28	2.40	1.70	27.8
Shamaspur	11.3	11.5	10.97	8.70	0.95	0.45	32.7
Naunera	54.0	36.7	6.56	6.36	2.83	2.12	14.1
Sohalpur Gara I	34.0	32.0	9.84	8.72	4.04	1.06	7.0
Ghiana	29.2	21.6	9.79	8.29	3.99	1.03	16.0
Arwah	25.7	14.1	8.36	10.16	0.62	0.84	19.6
Meharwani	41.5	25.4	11.12	9.80	4.47	1.32	19.0
Arithmetic Average	32.71	24.07	12.18	11.67	3.28	1.31	15.48

NOTE TO TABLE A.2:

For much of north-west India covering Punjab and Uttar Pradesh, a cultivator with an operational holding of 10 acres or more is considered to be beyond the stratum consisting of subsistence peasants. Table A.2 presents the relevant data for the group of cultivators with operational holdings of 10 acres and above in each of the villages. Four cases of Table A.1 could not be included in this Table because of inadequate breakdown of available data among different size classes; these cases are: Saran (1959-60), Sohalpur Gara (1958-59), Dughri and Dhakia.

A household with an annual income of about Rs. 1000 may be regarded as above the subsistence minimum for the period under consideration (i.e., the second half of the fifties). In many parts of Punjab and U.P. a 10 acre holding may be expected to yield (under normal weather conditions, and with the prices of the period) a net produce (i.e., net of all paid out costs of cultivation except rent) worth not much less than Rs. 1000. Farm Management Survey data for Punjab [10] shows this net value of produce from an acre of land in the two surveyed districts to be very nearly Rs. 100. This is corroborated by our analysis of net value of produce per acre (in Table A.3) for the selected villages, in less than one fifth of which the net value of produce per acre at current prices is significantly below Rs. 100. In 5 cases of this Table, viz., Saran, Meharwani, Arwah and Bahautwas (both surveys), a 10-acre holding did not yield at least Rs. 900-1000 of net farm income.

The norm for the above-subsistence income should perhaps change with changes in the price conditions and with differing volume and composition of consumption opportunities. A cultivator with, say, Rs. 700 of net farm income may not feel as badly placed in a remote, backward village like Bahautwas or Arwah as he would in a prosperous village situated near cities like the villages Sarai Naga or Kukar Majra. From this point of view, it may be quite legitimate not to exclude the 5 cases mentioned above from the sample of Table A.2. Regressions (c) and (c') of Table 1 are based on all the 27 observations listed in Table A.2, while regressions (d) and (d') are computed after excluding 5 of them.

Table A.3

Net Value of Crop Production per Standard Acre in the Selected Villages of Uttar Pradesh and Punjab

Village	Total Land Cultivated (in Standard Acres)	Gross Value of Production (Rs.)	Paid Cost (Cash and Kind) of Cultivation (Rs.)	Net Value of Crop Production (Rs.)	Net Value Crop Production per Acre (Rs.)
1	2	3	4	5	6
Rataul Rohe (1955-56)*	1037	119363	25888	93375	90.00
Palanpur	465	63704	9964	53740	115.65
Saran	1069	73146	37652	35494	33.20
Dughri	669	149015	37553	111462	166.50
Mehtiana	411	92398	41862	50536	122.80
Rawatpur	560	103651	22629	81022	144.60
Sohalpur Gara (1954-55)	390	57246	20052	37194	95.40
Sohalpur Gara (1958-59	409	91071	23206	67865	166.00
Walidpur	517	253583	70156	183427	354.44
Kukar Majra	365	114504	19000	95504	261.60
Koloyee	600	98770	19822	78948	131.48
Ghiana	641	137870	79915	57955	90.36
Patran	938	113095	18375	94720	101.00
Noorpur	1085	165071	62329	102742	94.68
Naunera	597	82134	5850	76284	127.68
Shamaspur	64	34988	12021	22967	357.50
Meharwani	587	77170	25800	51370	87.50
Sochiana	390	91451	17724	74727	191.50
Lodi Nangal	382	90770	25130	65941	172.60
Bhatian	441	174953	108063	66890	151.60
Sarai Naga	1668	452532	108850	343682	206.00
Kala Jhar	875	193068	78000	115068	131.50
Dhakia	548	124295	39274	85021	155.00
Arwah	936	67051	5800	62251	66.50
Akoi	667	177857	40819	137038	205.44
Bahautwas	1204	60744	5480	55264	45.90
Bhunderi	393	71948	20005	51943	132.00

Table A.3 (continued)

*All the necessary data for calculating net value of production per acre was not available for the second point survey of Ratual Rohe. But from a consideration of production of crops and prices during the two survey years, it seems that the net value of production per acre during the resurvey year was larger than it was during the initial year.

Note:

Cost of cultivation in Column 4 covers the following items: cash and kind wage payments to permanent and casual labourers (hired), cash and kind payments to artisans (like blacksmiths for repairing implements, masons for repairing wells and other farm buildings), purchased seed, purchased fodder, fertilizers and manures, irrigation charges, land revenue and 'panchayat' taxes (if any), oil for tractors, pumps, etc. The item that is excluded is rent paid by the cultivators. The reason for doing this is as follows. Rent payment has to be deducted (from gross produce) in calculating the net income of an individual cultivator. But when it comes to finding out the net value of produce from an acre of land in a village, rent may be treated more as an item in the distribution of net produce as between cultivators and non-cultivating land owners.

FOOTNOTES

[1]See, for example, Raj Krishna [9] and Behrman [2].

[2]See Raj Krishna [8], Krishnan [6], and Behrman [3].

[3]For illustration from different parts of India, we may mention the cases of Tanjore and Chingleput districts of Madras, Raipur district of Madhya Pradesh, West Godavari district of Andhra Pradesh, and Birbhum district of West Bengal. In all of these districts, foodgrains (primarily rice) usually account for 85 to 95 per cent of total cultivated area. Because of the particular soil-climate complex or other reasons, these cases have few other crops competing with foodgrains for land. It may also be noted that in view of insufficient intersectoral mobility of resources (particularly capital) in response to price changes, the competition from industrial goods as production alternatives for the Indian cultivators may be insignificant except in the very long run.

[4]This range is based on (a) expenditure elasticities of demand for foodgrains in the rural sector of India estimated by Krishnan [6] from different rounds of N.S.S. data and (b) on income elasticity of expenditure estimated to be 0.95 for the rural sector from the Reserve Bank of India's survey of rural savings and income as analyzed by Khatkhate and Deshpande [4].

[5]Based on estimates by Barpujari and Chandra [1] and Krishnan [5].

[6]Value of foodgrain output as percentage of total value of output of all crops and their byproducts was 54% in 1960-61 according to calculations by the National Council of Applied Economic Research [7]. The proportion was somewhat smaller than this during the First Plan period. A range of 0.45-0.55 seems plausible, taking account of these factors.

[7]This is Raj Krishna's estimate [9] of price elasticity of production for wheat in Punjab where it is the single most important foodgrain. For this calculation we have assumed γ_c (the elasticity of production of competing cash crops with regard to their price relative to foodgrains) to be same as γ_f. This, incidentally, is also the assumption used by Behrman [3] and Raj Krishna [8].

[8]From the findings of the Rural Credit Surveys for different years during the 1950's and the indirect estimates of the marketable proportion of production made by the Ministry of Food and Agriculture, an order of 30-33 per cent seems plausible for the major cereals: rice and wheat. The marketed proportion is substantially smaller in the case of millets and other inferior cereals which are mostly grown either for livestock feeding in the case of richer cultivators or for home consumption in the case of poorer cultivators. On the other hand, the marketed proportion of foodgrains was probably higher during the better years of this decade. Considering all this, a range of 25 to 33 per cent seems appropriate.

[9]Raj Krishna's estimate [8], even though indirect and aggregative in a similar manner, appears to be less uncertain about the sign of the long period elasticity for the following reason. Raj Krishna uses a narrower concept of income: the only income which he regards as relevant in the determination of the demand for on-farm consumption of foodgrains is the cash income obtained from the sale of foodgrains. This leads to underestimation of the effect of price changes on income and hence on consumption of grains by the cultivators. The assumption that the relevant income is the total income of the cultivators seems more appropriate.

[10]See pp. 12-13.

[11]Consider the following size-distribution in terms of cumulative percentages:

Cumulative Size Class	Cumulative Per Cent of Farms	Cumulative Per Cent of Area
Up to 5 acres	35	10
Up to 15 "	85	50
All farms	100	100

$$X_5 = \frac{|35-10| + |85-50| + |100-100|}{100} = .6$$

[12]This retention includes that for livestock feeding, the income elasticity for which may be fairly high in view of the importance of milk and milk products for many of these villages.

[13]The reason for fixing this limit is as follows. From the 15th Round of National Sample Survey of consumer expenditure data relating

to the year 1959-60, we note that the level of average annual foodgrain consumption among the richer sections of the rural population (i.e., the weighted average for those with monthly per capita consumption expenditure of at least Rs. 15) was about 7.5 maunds per capita and about 8.5 maunds per adult unit. Assuming that this approximates the average level of grain consumption among the larger cultivators (with more than 10 acres) of Punjab and Uttar Pradesh, and adding to this approximate figures for seed, wage payments in kind and livestock feed, one may regard the figure of 15 maunds per adult unit as a rough indicator (probably biased upward rather than downward) of the level of comfortable retention of foodgrains by the better-off cultivating households.

REFERENCES

[1] B.K. Barpujari and K. Chandra, "Consumer Demand for Important Commodities in the Third Plan," in V.K.R.V. Rao et al., (ed.), Papers on National Income and Allied Topics, Vol. II. Asia Publishing House, New York, 1962.

[2] J.R. Behrman, "Supply Response in Underdeveloped Agriculture: A Case Study of the Four Major Annual Crops in Thailand, 1937-1963," unpublished Ph.D. thesis, Massachusetts Institute of Technology, 1966.

[3] J.R. Behrman, "Price Elasticity of the Marketed Surplus of a Subsistence Crop," Journal of Farm Economics, Vol. 48, November 1966.

[4] B.R. Khatkhate and K.L. Deshpande, "Estimates of Saving and Investment in the Indian Economy: 1950-51 to 1962-63," Reserve Bank of India Bulletin, March 1965.

[5] T.N. Krishnan, The Role of Agriculture in Economic Development: An Economic Study of Price Relationships in India, 1950-62. Ph.D. dissertation at M.I.T., 1964.

[6] T.N. Krishnan, "The Marketed Surplus of Foodgrains: Is It Inversely Related to Price?" The Economic Weekly, (Bombay), Annual Number, February 1965.

[7] National Council of Applied Economic Research, New Delhi: Agricultural Income by States 1960-61, January 1965.

[8] Raj Krishna, "A Note on the Elasticity of the Marketable Surplus of a Subsistence Crop," Indian Journal of Agricultural Economics, July-September 1962.

[9] Raj Krishna, "Farm Supply Response in the Punjab (India-Pakistan) A Case Study of Cotton," The Economic Journal, September 1963.

[10] Ministry of Food and Agriculture, Government of India, Studies in the Economics of Farm Management in Punjab, 1956-57.